清華大学 材料学院

School of Materials Science and Engineering, Tsinghua University

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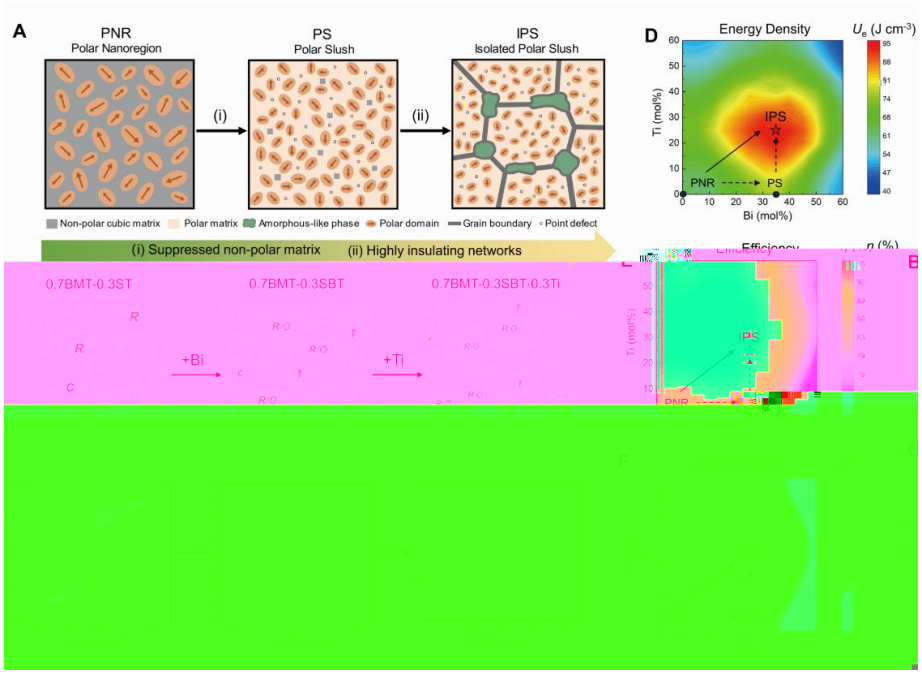
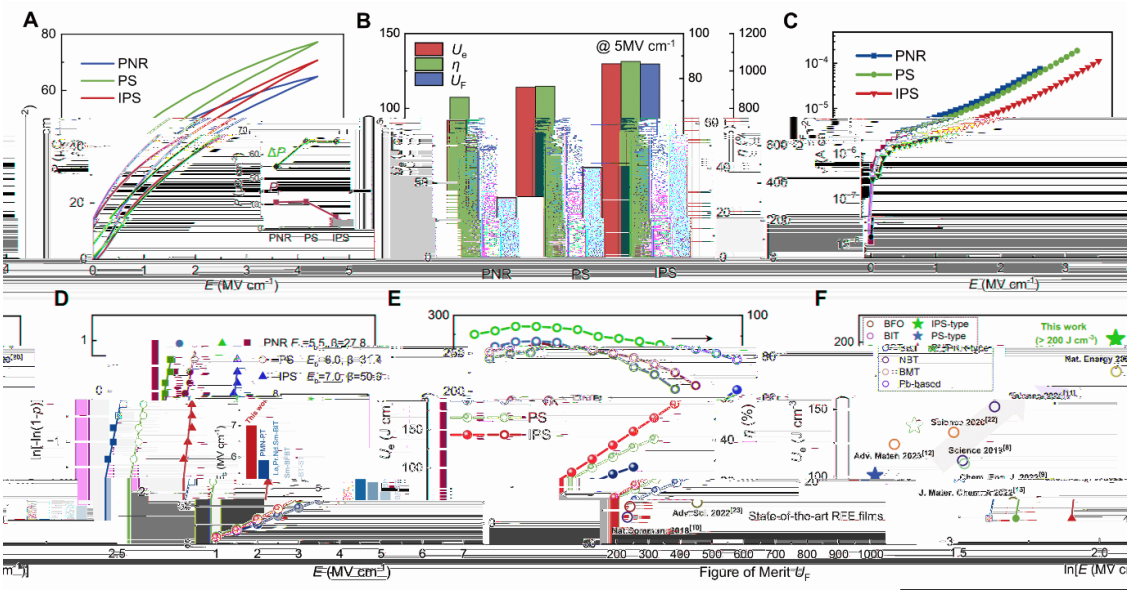
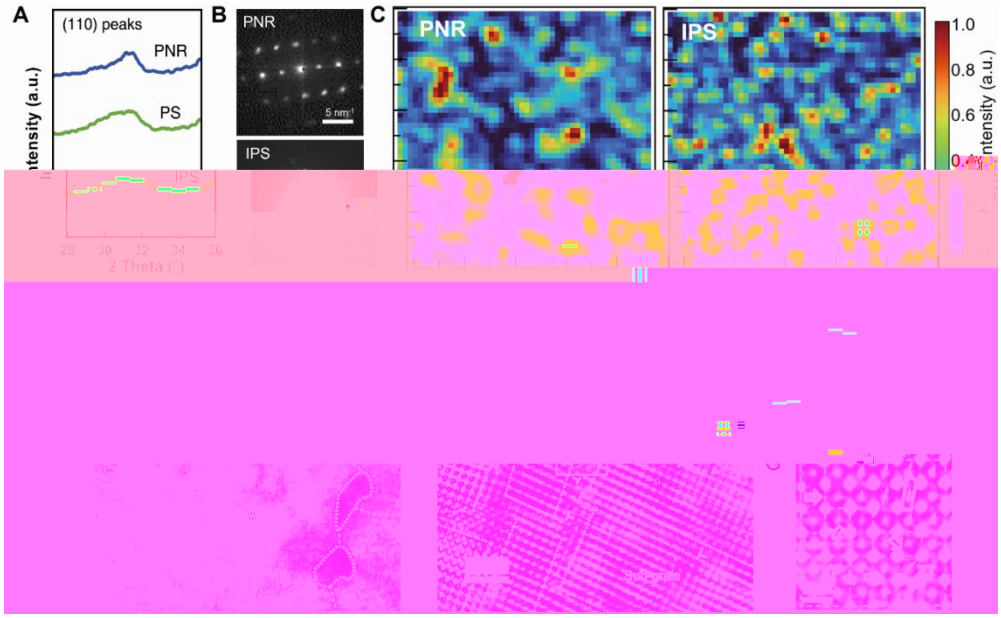
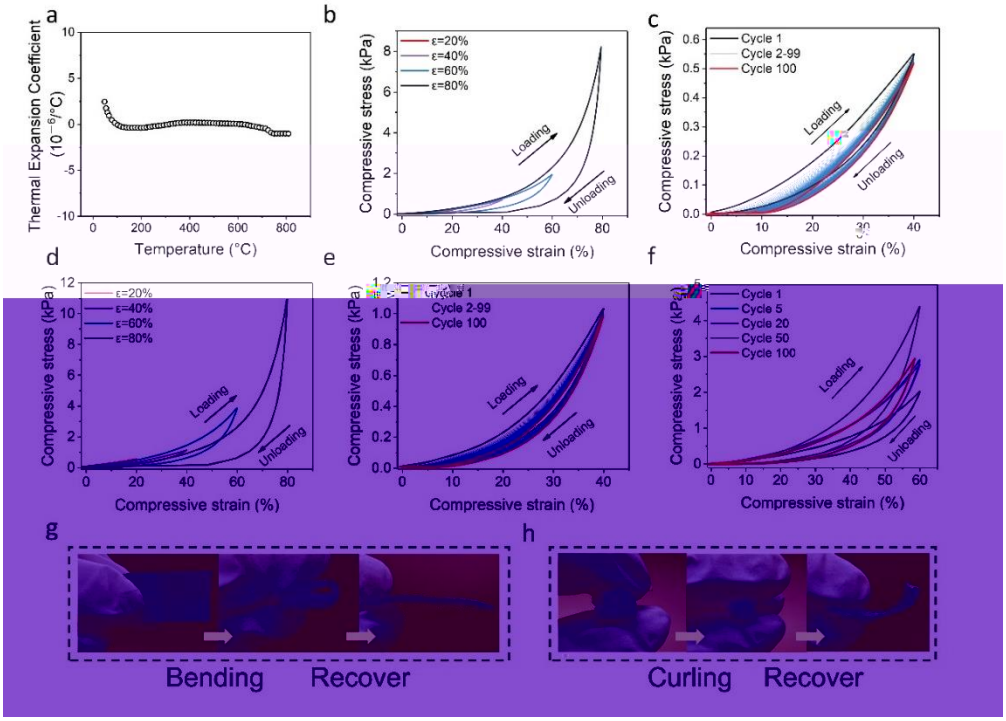
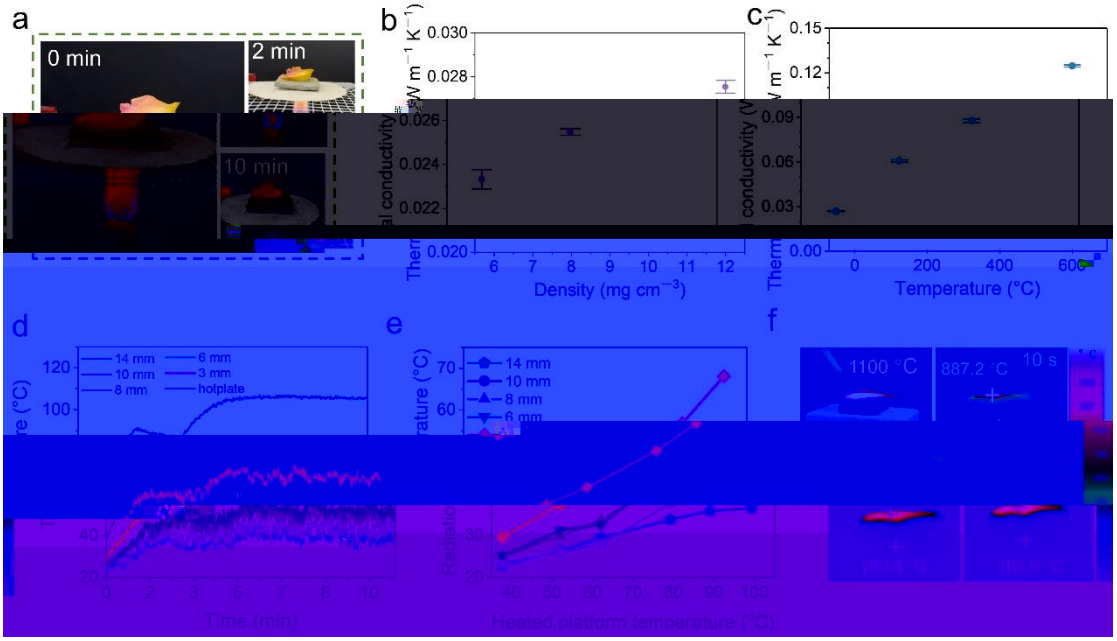
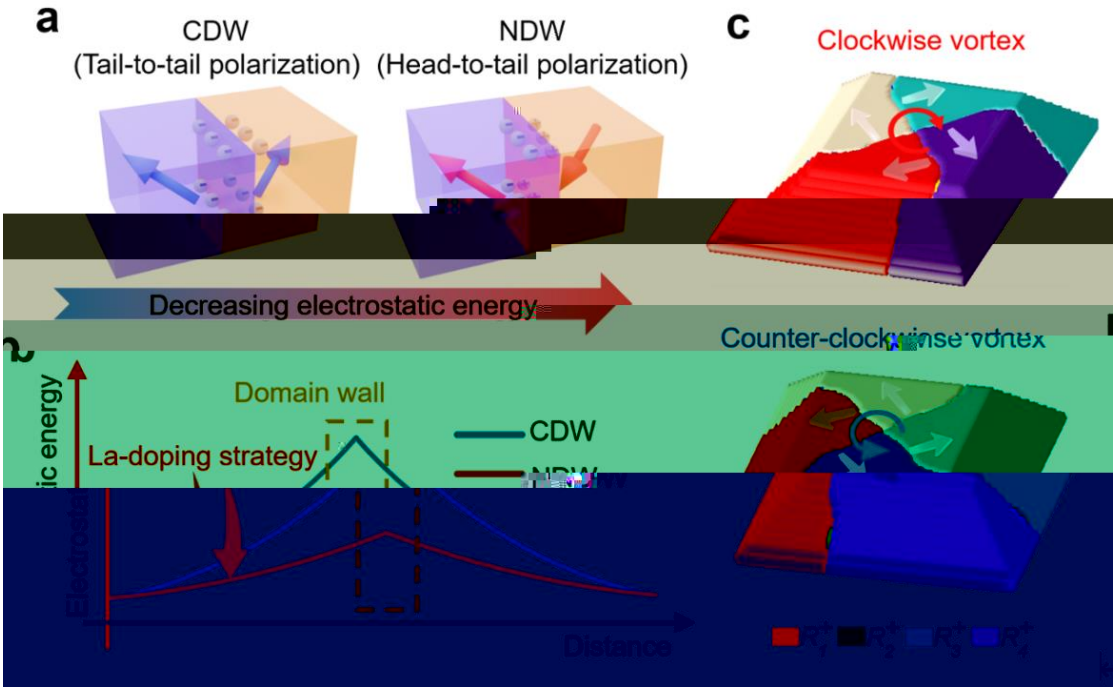

A
PNR
Polar Nanoregion
PS
Polar Slush
IPS
Isolated Polar Slush
(i)
(ii)
Non-polar cubic matrix
Polar matrix
Amorphous-like phase
Polar domain
Grain boundary
Point defect
(i) Suppressed non-polar matrix
(ii) Highly insulating networks
D
Energy Density
U_e (J cm^{-3})
Ti (mol%)
Bi (mol%)
IPS
PNR
PS
0.7BMT-0.3ST
0.7BMT-0.3SBT
0.7BMT-0.3SBT-0.3Ti
+Bi
+Ti

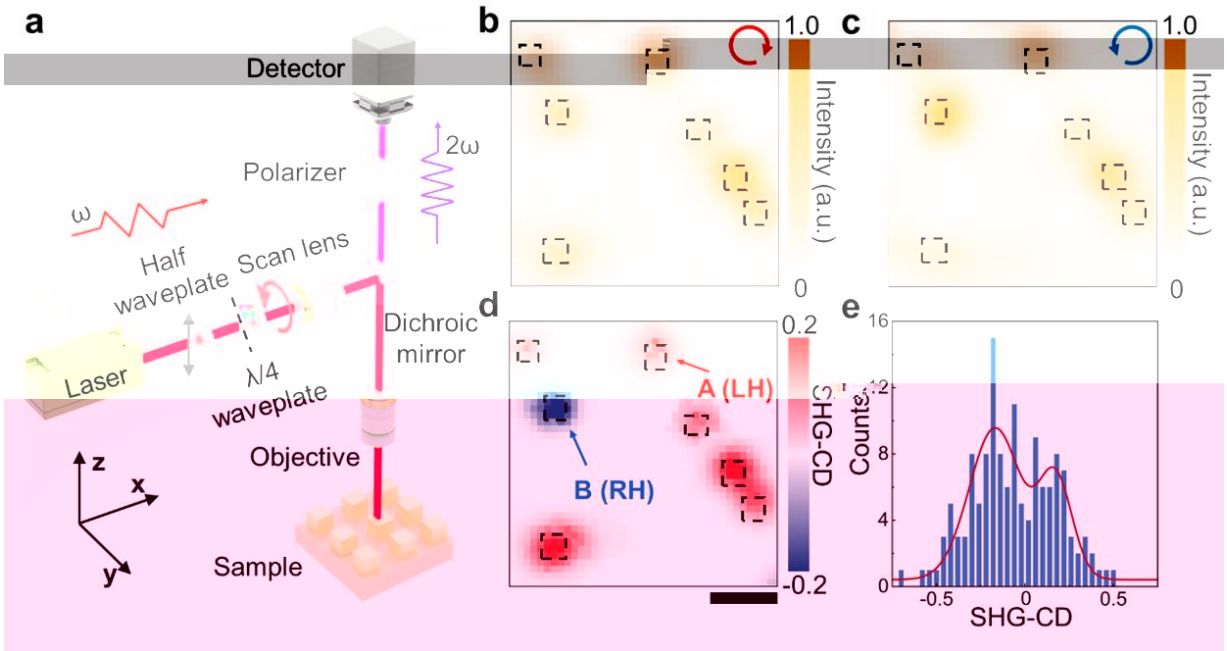

A
PNR
PS
IPS
ΔP
E (MV cm⁻¹)
B
@ 5MV cm⁻¹
PNR
PS
IPS
C
PNR
PS
IPS
E (MV cm⁻¹)
D
PNR
PS
IPS
E (MV cm⁻¹)
E
PS
IPS
Figure of Merit U_F
F
This work
(> 200 J cm⁻³)
BFO
BIT
NBT
BMT
Pb-based
IPS-type
PS-type
State-of-the-art REE films
E (MV cm⁻¹)

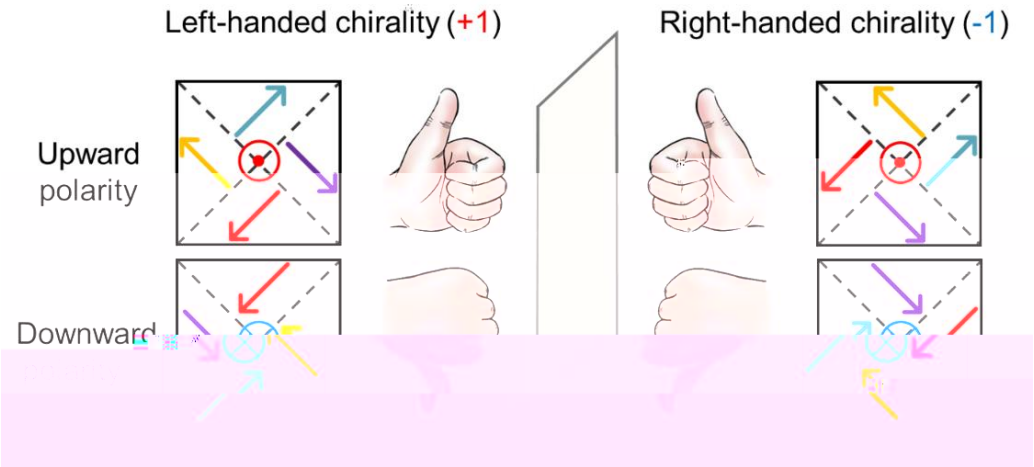

A
(110) peaks
PNR
PS
IPS
2 Theta (°)
B
PNR
5 nm⁻¹
IPS
C
PNR
IPS
1.0
0.8
0.6
0.4
Intensity (a.u.)

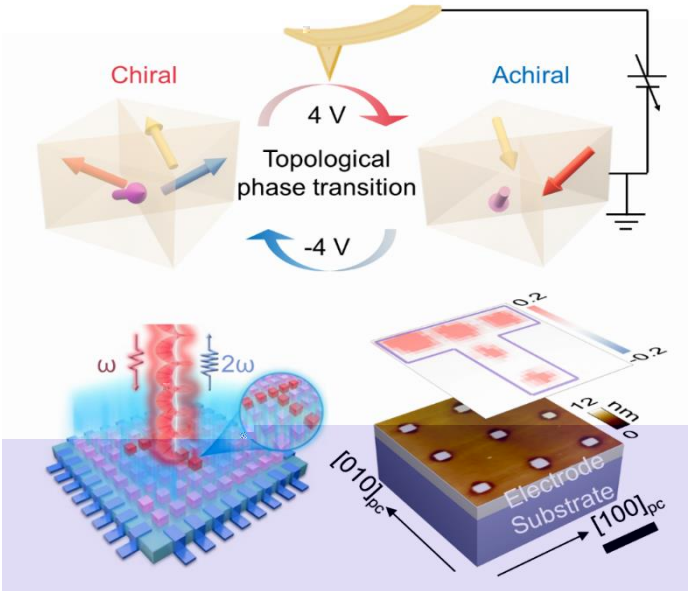

a
Thermal Expansion Coefficient (10^{-6}/°C)
Temperature (°C)
b
Compressive stress (kPa)
Compressive strain (%)
ε=20%
ε=40%
ε=60%
ε=80%
Loading
Unloading
c
Cycle 1
Cycle 2-99
Cycle 100
d
e
f
Cycle 5
Cycle 20
Cycle 50
g
Bending
Recover
h
Curling
Recover

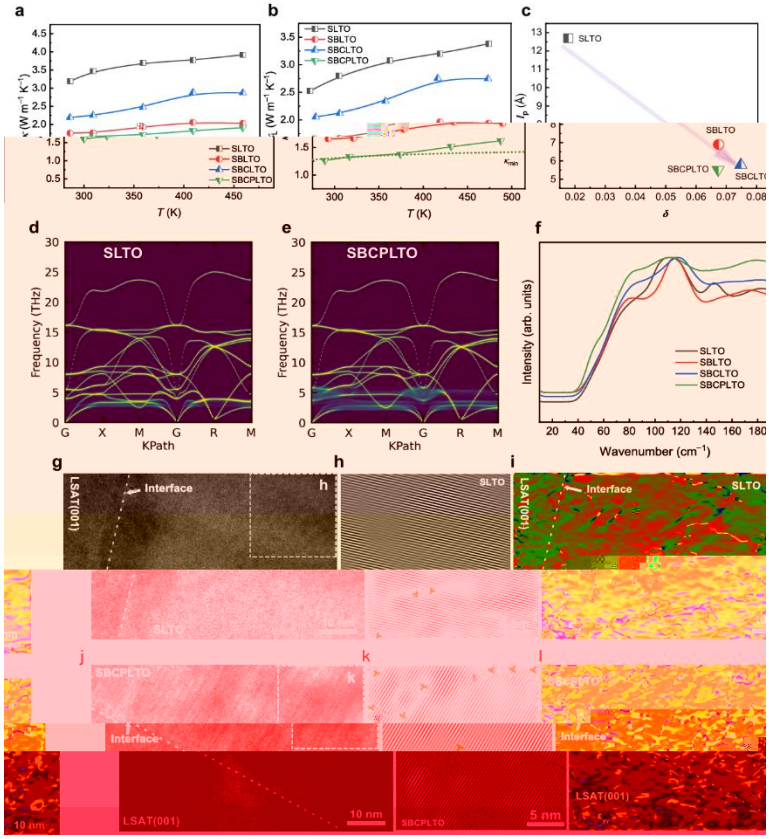

a
0 min
2 min
10 min
b
Density (mg cm^{-3})
c
Temperature (°C)
d
14 mm
10 mm
8 mm
6 mm
3 mm
hotplate
Time (min)
e
Heated platform temperature (°C)
f
1100 °C
887.2 °C
10 s

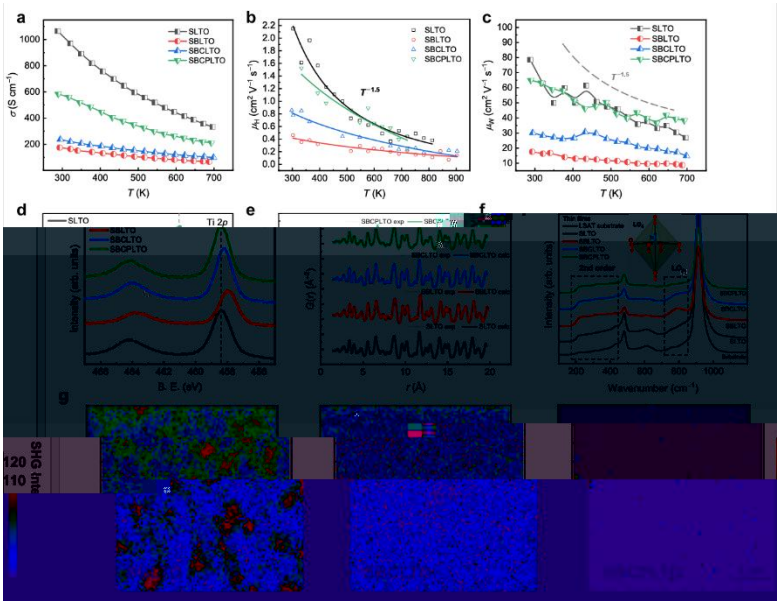

a
CDW
(Tail-to-tail polarization)
NDW
(Head-to-tail polarization)
c
Clockwise vortex
Decreasing electrostatic energy
Counter-clockwise vortex
Domain wall
La-doping strategy
CDW
Distance

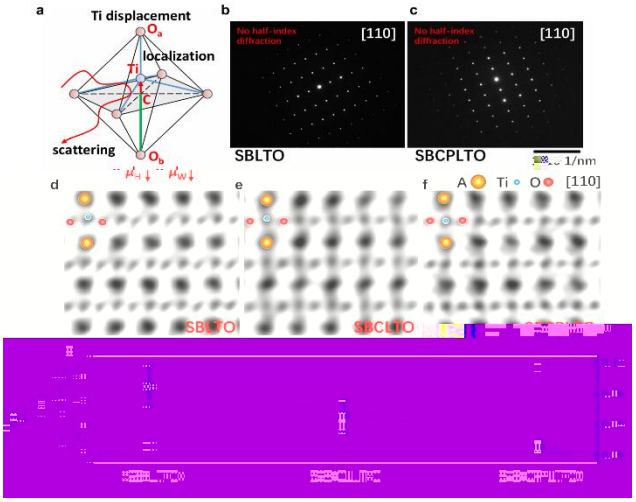

a
Detector
Polarizer
2ω
ω
Half
waveplate
Scan lens
Laser
λ/4
waveplate
Dichroic
mirror
Objective
Sample
z
x
y
b
1.0
0
Intensity (a.u.)
c
1.0
0
Intensity (a.u.)
d
0.2
-0.2
SHG-CD
A (LH)
B (RH)
e
16
12
8
4
0
Counts
-0.5
0
0.5
SHG-CD

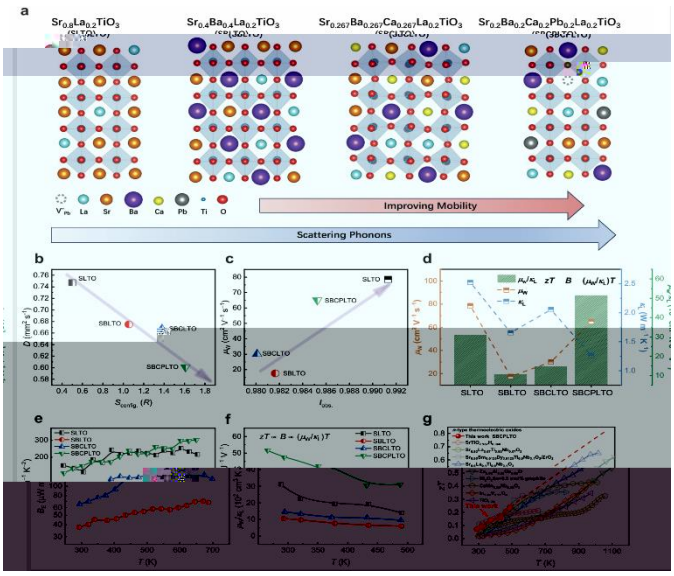

Left-handed chirality (+1)
Right-handed chirality (-1)
Upward
polarity
Downward

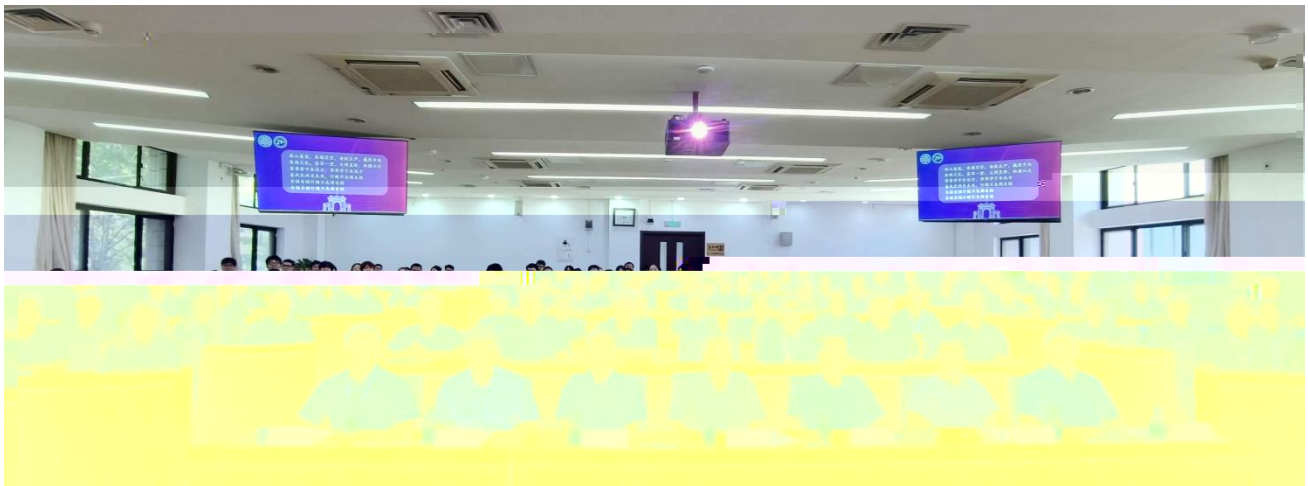

Chiral
Achiral
4 V
Topological
phase transition
-4 V
ω
2ω
0.2
-0.2
12
nm
0
[010]pc
[100]pc
Electrode
Substrate


a
b
c
SLTO
SBLTO
SBCLTO
SBCPLTO
T (K)
δ
d
e
f
Frequency (THz)
KPath
Intensity (arb. units)
Wavenumber (cm⁻¹)
g
h
i
j
k
l
Interface
LSAT(001)
10 nm
5 nm


a
b
c
d
e
f
g
SLTO
SBLTO
SBCLTO
SBCPLTO
T (K)
Ti 2p
B. E. (eV)
Wavenumber (cm⁻¹)
SHG Int.


a
Ti displacement
localization
scattering
b
No half-index diffraction
[110]
SBLTO
c
No half-index diffraction
[110]
SBCPLTO
1/nm
d
e
f
A
Ti
O
[110]
SBLTO
SBCLTO


a
Improving Mobility
Scattering Phonons
b
c
d
e
f
g
SLTO
SBLTO
SBCLTO
SBCPLTO



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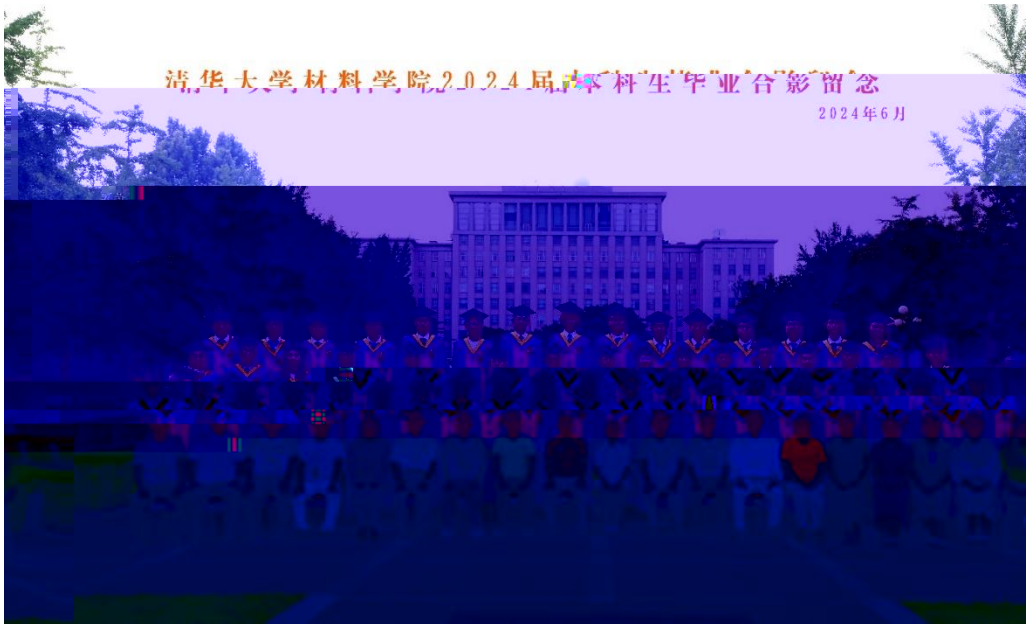
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2024年6月

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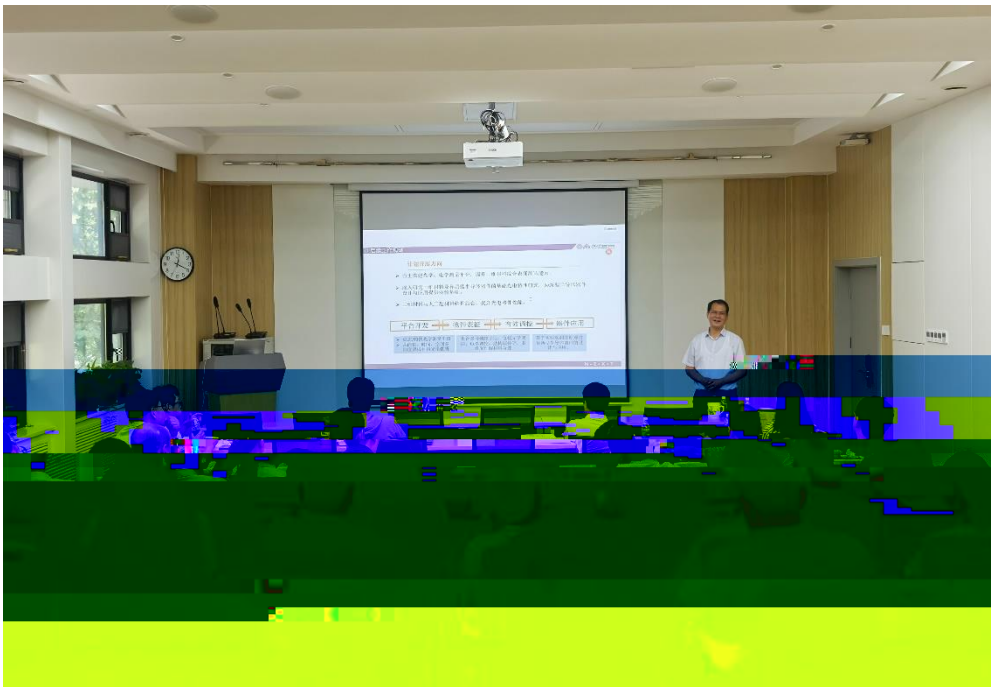
“新材强国”学术沙龙第四期



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